

New EOS for Mercury Vapor up to 1650 K and 130 MPa

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In the " Thermophysical Properties of Mercury", M.P. Vukalovich et. al, Moscow, 1971 give a vapor phase equation of state (EOS) and tables of the thermodynamic properties calculated up to 20 MPa. Now we have some new experimental data for mercury vapor: pVT-data (I.K. Kikoin, A.P.Senchenkov (1967); S.P. Naurzakov (1973); W.Goetzlaff (1988)), sound velocity (V.F. Kozhevnikov et al., (1999)). These new data and saturated vapor pressures $P_s(T)$ (from the Gibbs equation $G'(T, P_s) = G''(T, H_{vap}, P_s)$ up to 1650 K were simultaneously approximated by the: 1) weighted nonlinear least squares; 2) ES in the virial form with the 2d, 3d, 4th and 5th virial coefficients; 3) interatomic potential Lennard- Jones m-6 type with 3 parameters d , ϵ , m . Virial coefficients (for additive interatomic forces) we have from P.Reipert's dissertation (1978) for $m=9, 12$ and 18 .

The results are: 1) $d = 2.78 \pm 0.03$ Å, $\epsilon = 818.4 \pm 50$ K, $m = 8.4 \pm 0.6$, $H_{vap}(0 \text{ K}) = 64530 \pm 45$ J/mol , and their error matrix; 2) new extended tables for the saturated and superheated vapor (Z , h , s , C_p , C_v , a and P_s - T_s (ordinary notations) up to 130 MPa. The main question is: from new spectroscopy data for Hg 2 we have $\epsilon < 550$ K, why?